WORKING DRAFT BDCP HCP/NCCP Biological Goals and Objectives

The conservation strategy is designed to achieve a tiered set of biological goals and objectives which are organized into the three tiers of ecosystem goals and objectives, natural community goals and objectives, and species-specific goals and objectives. Goals are broad, guiding principles based on conservation needs of the Bay Delta system and the covered species and natural communities which depend upon it. Objectives are intended as more specific expressions of those general goals addressing more specific functions or life history stages, depending upon the overriding goal within which they are embedded. Objectives are intended to be clear, succinct, measurable and achievable within a given time frame; they clearly state a desired result and will collectively achieve the biological goals.

These goals and objectives are intended to encompass the ecological functions within the Delta that are important for covered species. They thus relate directly to the functions of habitats within the Delta that have been designated as "critical habitats" for covered species by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. Table XXX correlates these goals and objectives to the elements of critical habitats within the Delta deemed important by both Services for species proposed to be covered by the BDCP.

Monitoring metrics and other more quantified metrics (or "targets") that may be associated with these monitoring metrics accompany these objectives. The purpose of these metrics is to describe how progress will be measured towards or away from these goals and objectives over the course of plan implementation. These metrics are further described and integrated into the monitoring program described in Chapter 3.X and the Adaptive Management Program described in Chapter 3.Y. They are intended to enable the implementing entities and other interested parties to track how the implementing of the conservation measures may be effectuating improvements in the system as a whole at the larger scale of these objectives. In some cases, these metrics may be identical to those deployed to track the effectiveness of individual conservation measures; in other cases, the metrics may differ from those used at the conservation measure level.

These metrics may change over time as new capabilities emerge to track performance in achieving these plan objectives and as the scientific understanding of the ecological and biological functions of the Bay Delta evolve. They are intended to serve as an essential component of the monitoring and adaptive management program for the plan, and may be changed as that program evolves.

The proposed quantified metrics are expressed in a number of ways, depending upon the biological or ecological objective with which they are associated. Certain of these targets are expressed as overall improvements in primary or secondary productivity, while others are expressed as improvements in survivals of particular life stages (e.g. juvenile migrations) or for a population as a whole. These quantified metrics are intended to serve

as technical expressions of when a particular functional objective is being achieved, regardless of whether this is the result of implementation of BDCP-related measures or through improvements in function or survivals from other natural or human induced conditions outside the scope of the BDCP. They are proposed here where there exists sufficient information to support such a quantitative threshold; in other circumstances, they may await further advances in understanding how these metrics may relate to the underlying objectives, in which case they are expressed here as having a "to be determined" (TBD) status. As with the monitoring metrics themselves, they are intended to be subject to refinement or substitution as scientific understanding of the system evolves.

The "metrics" embedded here also differ from the firm, measurable commitments in the specific conservation measures and that are intended to define with specificity the obligations of the BDCP permittees. These commitments (e.g. total acreages, quantified operational parameters or level of investments) are currently (or will be) built into the conservation measures themselves and will be carried forward into the Implementing Agreement for the BDCP and the terms and conditions in the ensuing permits. For brevity purposes; they are not necessarily pulled forward here in these monitoring metrics and targets because they serve a different function. Both the monitoring metrics and monitoring targets described here and the firm, quantifiable commitments in the conservation measures will be carried forward into the planning process.

For further additional information on the need for and function of goals and objectives in conservation plans, please see the Addendum to the HCP Handbook issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in 65 Federal Register 35242 on June 1, 2000.

Ecologically Hierarchical Organization of Biological Goals and Objectives

The biological goals and objectives are organized hierarchically, on the basis of ecological scale, as follows:

- 1. Ecosystem Goals and Objectives
 - 2. Natural Community Goals and Objectives
 - 3. Species-Specific Goals and Objectives

The scope of each ecological scale is as follows:

Ecosystem Goals and Objectives. Ecosystem goals and objectives are focused on improvements to the overall condition of hydrological, physical, chemical, and biological processes in the Delta. Goals and objectives are directed at improving ecosystem conditions in support of native Delta fishes and their habitats.
 Conservation measures that would achieve the objectives are directed at contributing to the recovery of BDCP covered fish species. Because other native

aquatic species and the covered fish species have co-evolved within the Delta ecosystem, improvements to the Delta ecosystem that benefit the covered fish species are also expected to benefit other native aquatic species.

- Natural Community Goals and Objectives. Natural community goals and objectives are focused on maintaining or enhancing ecological functions and values of covered natural communities. Achieving natural community goals and objectives will improve the habitat of associated covered species and other native species.
- Covered Species Goals and Objectives. Species-specific goals and objectives address species-specific stressors and habitat needs that are not addressed under the higher order ecosystem and natural community goals and objectives and species-specific viability parameters as they relate to life stage occurrence of covered fish species in the Delta.

Goal ECSY 1: Provide hydrodynamic conditions within Delta waterways that mimic more natural patterns of flow within the BDCP planning area and Suisun Marsh.

Problem Statement: Current Hydrodynamic conditions within the Delta act as ecosystem stressors by affecting species movement among habitats (straying), natural hydrologic variability, limiting habitat availability and suitability, creating conditions favoring non-native invasive species, and limiting food production. Improving these hydrodynamic conditions, so they are naturally dynamic, will relieve the adverse effects of these functions of the Delta ecosystem for covered species.

Covered species benefiting: Delta Smelt, longfin smelt, splittail, all runs of Chinook, steelhead, green and white sturgeon. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., estuarine rearing and migration area), and delta smelt (i.e., spawning habitat, larval and juvenile transport, rearing habitat, and adult migration) in the area of the BDCP.

Ecosystem Goals and Objectives

Objective ECSY1.1: Improve hydrodynamic conditions to support the movement of larval and juvenile life stages of native fish species to downstream rearing habitats.

Monitoring Metrics: Delta Outflows

Other metrics to track seasonal flow patterns

Particle Tracking

¹ See Table XXX

Juvenile fish surveys, including route selection

studies

Percentage increases in floodplain availability

Water quality parameters (?)

Metric Targets: (TBD)

Objective ECSY1.2: Improve hydrodynamic conditions to support the movement of adult life stages of native fish species to natal spawning habitats.

Monitoring Metrics: Adult tracking surveys

Other tracking metrics as embedded in the parameters for certain operational measures related to Sacramento River and San Joaquin River outflows, cross channel operations, etc.

Water quality parameters (?)

Metric Targets: TBD

Objective ECSY 1.3: Improve hydrodynamic conditions to provide salinity regimes and other water quality conditions within the Delta to help restore suitable native fish habitat and to support the effective movement of and food production for native fishes.

Monitoring Metrics: Extent of low salinity zone (km)

Interannual variation in food production

Other TBD

Metric Targets: (TBD)

Objective ECSY1.4: Improve flows throughout the Delta that mimic the annual and interannual variability present in the natural hydrograph to maintain or increase life history diversity of native fishes and to provide for a diversity of rearing conditions for native fishes over time.

Monitoring Metrics: (TBD)

Metric Targets: (TBD)

Objective ECSY 1.5: Improve the east to west freshwater flow patterns in the Delta to better mimic the historical east-west flow patterns that had characterized the Delta to provide increased connectivity between low salinity zone habitats and upstream freshwater habitats and availability of spawning habitats for native pelagic species.

Monitoring Metrics: Modeling to correlate flows and salinity

connectivity between low salinity zones and

freshwater habitats; Other metrics TBD.

Metric Targets: (TBD)

Goal ECSY 2: Increase aquatic primary and secondary production in the Delta and Suisun Marsh to increase the abundance and availability of food for native aquatic organisms.

Problem Statement: Current hydrodynamic conditions, water quality, quantity of functional inter-tidal and floodplain habitat, and the presence of non-native invasive species limit primary and secondary production in the Delta affecting its ability to support delta smelt, longfin smelt, juvenile salmonids and other native species. Increasing primary and secondary production will improve food web processes and the availability and abundance food items at multiple trophic levels.

Covered species benefiting: Delta smelt, longfin smelt, all runs of salmon, steelhead, green and white sturgeon, splittail, river lamprey, and Pacific lamprey.

The following ecosystem and natural community objectives that also contribute towards achieving this goal: ECSY1.3, ECSY3.1-3.2, ECSY4.1, ECSY5.1, and NACO1.1-1.3.

Objective ECSY2.1: Over the term of the BDCP, increase the abundance of aquatic invertebrate species that provide food and support food production for covered fish species in Delta waterways.

Monitoring Metrics: Zooplankton surveys across representative Delta

and Suisun Marsh locations;

Benthic invertebrate surveys across representative

Delta and Suisun March locations

Early Metric Target: Increase the mean abundance of zooplankton and

benthic invertebrates sampled at [[Delta waterway locations]] during winter, spring, summer, and fall relative to mean abundance present during these periods from 200 to 20.

Overall Metric Target: Increase the mean abundance of zooplankton and

benthic invertebrates sampled at [[Delta waterway locations]] by at least ___ percent during winter, ___ percent during spring, ___ percent during summer, and ___ percent during

fall relative to mean abundance present during these periods from 200 to 20 ...

Goal ECSY 3: Reduce the adverse effects of non-native species on Delta ecosystem processes and native aquatic species.

Problem Statement: Alterations of the Delta ecosystem caused by non-natives species have reduced habitat suitability (turbidity effect, changes in habitat structure), and changed predator-prey and competitive relationships between native and non-native species are a major stressor on covered fish species. Reducing the adverse effects of non-native species is expected to increase survival and abundance of covered fish species.

Covered species benefiting: Delta smelt, longfin smelt, all runs of salmon, steelhead. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., estuarine rearing and migration area) in the area of the BDCP.²

Objective ECSY3.1: Manage the distribution and abundance of established non-native invasive species in the Delta to reduce non-native species predation on and competition with native fishes and to rehabilitate aquatic ecosystem processes.

Monitoring Metrics: Distribution and abundance of targeted non-native species

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., removal targets for Egeria)]

Objective ECSY3.2: Minimize the likelihood for future invasions and establishment of non-native species into the Delta's aquatic ecosystem.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., number of boats inspected for presence of non-native organisms)]

Goal ECSY 4: Reduce the adverse effects of contaminants on the Delta's aquatic ecosystem.

Problem Statement: A variety of contaminants entering Delta waterways are hypothesized to have direct lethal and sublethal effects on fish species and food web processes that adversely affect food abundance and availability. Reducing the loads of

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² See Table XXX

contaminants of concern entering the Delta is expected to increase survival and abundance of covered fish species.

Covered species benefiting: Delta smelt, longfin smelt, all runs of salmon, steelhead, green and white sturgeon, splittail, river lamprey, and Pacific lamprey. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., estuarine rearing and migration area in the area of the BDCP).³

Objective ECSY4.1: Contribute to specific actions which have a demonstrated positive effect in improving the aquatic ecosystem by reducing the load of contaminants of concern entering the Delta.

Monitoring Metrics: (TBD)

Metric Targets: (TBD)

Goal ECSY5: Increase the extent and improve the amount, spatial distribution, function, and connectivity of natural communities across the Delta and the connectivity with communities upstream and downstream of the Delta to support ecosystem productivity and the effective movement and genetic exchange of covered species within and among natural communities both inside and outside of the BDCP planning area.

Problem Statement: Insufficient area, function, and connectivity among and accessibility to natural communities within and outside the BDCP planning area is hypothesized to inhibit proper ecosystem function and support for native species. Expanding the extent and improving the function and connectivity between and accessibility to natural communities will enhance ecosystem processes and productivity to support improved abundance, distribution, diversity, and growth of covered species populations and other native species.

Covered species benefiting: Delta smelt, longfin smelt, all runs of salmon, steelhead, green and white sturgeon, splittail, river lamprey, Pacific lamprey, terrestrial species to be determined (clapper rail, black rail, delta plants associated with intertidal and flood plain, Swainsons hawk, VP species, cranes. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., freshwater rearing, freshwater migration corridors, and estuarine rearing and migration area), and delta smelt (i.e., spawning habitat, larval and juvenile transport, rearing habitat, and adult migration) in the area of the BDCP.4

The following ecosystem and natural community objectives also contribute towards achieving this goal: ECSY1.1-1.3 and NACO1.1-1.5.

³ See Table XXX ⁴ See Table XXX

Objective ECSY5.1: Protect and expand the availability of spatially well-distributed aquatic and terrestrial natural communities to support increased distribution of covered species, aquatic productivity, and improved connectivity among natural communities within and adjacent to the BDCP planning area.

Monitoring Metrics: Extent, distribution, and connectivity of among

natural communities.

Metric Targets: (TBD)

Natural Community Goals and Objectives

Goal NACO1: Protect, enhance, and restore natural communities to provide habitat and ecosystem functions to increase the natural production (reproduction, growth, and survival), abundance, and distribution of native Delta species.

Problem Statement: Habitat essential for the spawning, incubation, rearing, and foraging of native fishes has been degraded around the Bay Delta, and this has restricted species distribution, life history diversity, and growth of covered fish species. Increasing habitats is expected to increase distribution, life history diversity and growth of covered fish species. [[Need to revise or add statement for covered terrestrial species]].

Covered species benefiting: All BDCP covered species would be expected to benefit. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., freshwater rearing, freshwater migration corridors, and estuarine rearing and migration area), and delta smelt (i.e., spawning and rearing habitat) in the area of the BDCP.⁵

Objective NACO1.1: Increase hydrologic connectivity of Delta waterways with existing and historical floodplains to support habitat and food production for associated native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., frequency, duration, and extent of Yolo Bypass inundation)]

Objective NACO1.2: Increase the extent and spatial distribution of tidal marsh within the Planning Area and Suisun Marsh to support habitat and food production for associated native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of restored habitat)]

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⁵ See Table XXX

Objective NACO1.3: Increase the extent and spatial distribution of riparian forest and scrub within the Planning Area to support habitat and food production for associated native species and increase connectivity among native habitats within and adjacent to the Planning Area.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of restored habitat)]

Objective NACO1.4: Preserve pasture lands and lands that are farmed for rice, alfalfa, and row crops in and adjacent to the Planning Area that are managed to support habitat for native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of preserved ag lands)]

Objective NACO1.5: Preserve grassland communities in and adjacent to the Planning Area that support habitat for associated native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of protected habitat)]

Objective NACO1.6: Preserve natural seasonal wetlands, including vernal pools and their micro-watersheds, and managed wetlands in and adjacent to the Planning Area that support habitat for associated native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of protected habitat)]

Objective NACO1.7: Preserve non-tidal perennial aquatic and associated non-tidal perennial permanent emergent marsh communities in and adjacent to the Planning Area that support habitat for associated native species.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., extent and location of protected habitat)]

Covered Species Goals and Objectives

General Covered Fish Species

Goal GECF1: Increase the abundance of covered fish species by reducing sources of unnatural mortality.

Problem Statement: Non-natural sources of mortality are hypothesized to inhibit the abundance and distribution of covered species and the diversity and growth of their populations. Reducing the proportion of covered fish species populations that are subject to loss from these mortality sources will support increasing the abundance, distribution, diversity, and growth of covered fish species populations.

Covered species benefiting: Delta smelt, longfin smelt, all runs of salmon, steelhead, lamprey, and sturgeon. Achieving this goal will also address certain elements of critical habitat requirements for spring-run and winter-run Chinook salmon and Central Valley steelhead (i.e., estuarine rearing and migration area), and delta smelt (i.e., spawning habitat, larval and juvenile transport, rearing habitat, and adult migration) in the area of the BDCP. ⁶

Objective GECF1.1: Reduce the entrainment mortality of native fish by the operation of the CVP and SWP.

Monitoring Metrics: Entrainment and salvage surveys

Particle tracking Others TBD

Metric Targets: (TBD)

Objective GECF1.2: Reduce entrainment mortality of covered fish species at non-project diversions

Monitoring metrics: TBD

Metric targets: TBD

Objective GECF1.3: Contribute towards reducing the risk for dissolved oxygen sags in Delta and Suisun Marsh waterways that could result in mortality of covered fish species.

Monitoring metrics: Dissolved oxygen concentration

Metric targets: TBD

Objective GECF1.4: Minimize the adverse effects of harvest on longfin smelt, green and white sturgeon, splittail, and all runs of Chinook salmon.

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⁶ See Table XXX

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., increased levels of law enforcement)]

Goal GECF2: Reduce impacts of hatcheries on the genetic integrity of artificially propagated and natural populations of covered fish species.

Problem Statement: Hatcheries lower the genetic fitness and support negative ecological interactions between hatchery and wild individuals, which inhibit the abundance, life history diversity, and growth of self-sustaining populations of covered species. Reducing the negative impacts of hatcheries on the genetic integrity and ecological interactions between propagated and wild covered fish species populations will support improved abundance, distribution, diversity, and growth of covered fish species populations.

GECF2.1: Minimize the adverse effects of salmonid hatcheries on the genetic integrity of wild Chinook salmon and steelhead populations.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., increased levels of law enforcement, hatchery genetic management plans)]

GECF2.2: Maintain or establish genetic refugia for delta smelt and longfin smelt to reduce the risk for the extinction of delta smelt and the extirpation of longfin smelt.

[Note: metrics, targets, and monitoring for this objective would be the same as those provided for in the relevant conservation measures (e.g., increased levels of law enforcement)]

Delta Smelt

Goal DESM1: Create conditions that support a self-sustaining population of delta smelt in the Delta and Suisun Bay.

Problem Statement: Current ecological, community, and biological conditions are leading to the extinction of delta smelt. Self-sustaining populations require conditions that provide for adequate, spatial distribution, abundance, and population growth. It is hypothesized that ecological, community, and biological conditions can change to support a self sustaining populations when if they adequately provide for the above characteristics

The following ecosystem, natural community, and general covered fish species objectives that also contribute towards achieving this goal: ECSY1.1-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, GECF1.1-1.3, and GECF2.2.

Objective DESM1.1: Increase the abundance of delta smelt within the Delta and Suisun Bay to levels that will support a self-sustaining delta smelt population in the Delta.

Monitoring metrics: Fall Mid-water Trawl surveys Other monitoring surveys TBD

Metric targets: Current estimates for what may constitute a self-

sustaining Delta smelt population are expressed as: a. Combined FMWT surveys in Sept/October for any five year period that exceed 29 in two years and that the two year running average will not drop

below 84; or

b. In any 10 year period, the FMWT index will not be less than 100 for any one year and will exceed 500 in at least 3 years, and exceed 1,000 in

at least 1 year.¹

Objective DESM1.2: Increase delta smelt population growth rates from years of comparable hydrology under existing conditions to levels that will contribute to the long-term sustainability of the smelt population in the Delta.

Monitoring metrics: FMWTSurveys

Other surveys TBD

Metric targets: FMWT index equals or exceeds in wet years

and does not drop below in any year.

Longfin Smelt

Goal LOSM1: Create conditions that support a self-sustaining population of longfin smelt in the Delta and Suisun Bay.

Problem Statement: [To come.]

The following ecosystem, natural community, and general covered fish species objectives that also contribute towards achieving this goal: ECSY1.1-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, GECF1.1-1.4, and GECF2.2.

Objective LOSM1.1: Increase the abundance of longfin smelt within the Delta and Suisun Bay to levels that will contribute to supporting a self-sustaining longfin smelt population in the Delta.

Monitoring metrics: FMWT Surveys

Other surveys TBD

Metric targets: Current estimates for what may constitute a self-

sustaining longfin smelt population are when the FMWT index equals or exceeds 5,000 in wet years

and does not drop below 100 in any year.

Objective LOSM1.2: Increase longfin smelt population growth rates in the Delta and Suisun Bay to levels that will contribute to the long-term sustainability of the longfin smelt population in the Delta.

Monitoring metrics: FMWT Surveys

Other surveys TBD

Metric Targets: Same as LOSM1.1, above.

Chinook Salmon

Goal CHIN1: Increase the survivals of juvenile Chinook salmon rearing in and migrating through the Delta to contribute to the long-term viability of Chinook salmon populations.

Problem Statement: Mortality rates of juvenile Chinook salmon attributable to multiple factors within the Delta are hypothesized to be excessive and a factor inhibiting the growth of Chinook salmon populations. Reducing mortality rates of juvenile Chinook salmon in the Delta will support improved abundance, distribution, diversity, and growth of Chinook salmon populations.

The following ecosystem, natural community, and general covered fish species objectives also contribute towards achieving this goal: ECSY1.1, ECSY1.3-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, GECF1.1-1.4, and GECF2.1.

Objective CHIN1.1: Increase the survival of juvenile Sacramento Basin springrun, fall run and winter run of Chinook salmon rearing in and migrating through the Delta to Chipps Island to levels that will contribute to the long-term viability of their populations.

Monitoring metrics: Juvenile survival surveys

Metric targets: Increase juvenile survival of the spring run by

percent, of the fall/late fall-run Chinook salmon by percent, and of the winter-run Chinook salmon by percent from mean survival rates observed

from [year] to [year].

Objective CHIN1.2: Increase the survival of juvenile San Joaquin Basin fall-run Chinook salmon, including the Mokelumne and Cosumnes River salmon, rearing in and migrating through the Delta to Chipps Island to levels that will contribute to the long-term viability of the population.

Monitoring metrics: Juvenile survival surveys

Metric targets: Increase juvenile survival of the fall run chinook

population by percent from mean survival rates

observed from [year] to [year].

Objective CHIN1.3: When a spawning population of spring-run Chinook salmon is established in the San Joaquin River, provide for survival of San Joaquin Basin spring-run Chinook salmon rearing in and migrating through the Delta to Chips Island to levels that will support the long-term viability of the population.

Monitoring metrics: Juvenile survival surveys

Metric targets: Mean annual juvenile survival levels of

percent averaged across years.

Goal CHIN2: Increase the growth of juvenile Chinook salmon that pass through and rear in the Delta to increase the likelihood for survival of juvenile Chinook salmon in San Francisco Bay and ocean habitats.

Problem Statement: Vulnerability to poor ocean conditions is hypothesized to increase when salmonid smolts enter the ocean smaller than optimal. Riverine ecosystems tend to not be highly productive, while estuarine ecosystems tend to be more productive and it is hypothesized smolts encounter these habitats needing to grow rapidly to ensure ocean survival. Increasing growth of juvenile Chinook in the Delta is expected to increase the likelihood of survival of juveniles.

The following ecosystem, natural community, and general covered fish species objectives also contribute towards achieving this goal: ECSY1.1, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, and NACO1.1-1.3.

Objective CHIN2.1: Increase the mean weight and length of juvenile Sacramento Basin spring-run Chinook salmon, fall/late fall-run Chinook salmon, and winter-run Chinook salmon rearing in and migrating through the Delta to Chipps Island.

Monitoring metrics: Weight and length of juvenile salmonids

Metric targets: TBD

Objective CHIN2.2: Increase the mean weight and length of juvenile San Joaquin Basin fall-run Chinook salmon, including the Mokelumne and Cosumnes River salmon, rearing in and migrating through the Delta to Chipps Island.

Monitoring metrics: Weight and length of juvenile salmonids

Metric targets: TBD

Goal CHIN3: Increase life history diversity of all runs of Chinook salmon.

Problem Statement: The loss of life history diversity is expected to reduce the viability of salmonid populations. Life history is defined as the lifetime patterns in growth, life stage differentiation, and reproduction. For salmonids, life history traits include the timing of downstream juvenile out-migrations, the timing and patterns of ocean rearing and migrations, the timing of adult upstream in-migrations, and the age of returning spawners. Retention of life history diversity is important for Chinook salmon because it is hypothesized to buffer populations from increased environmental or stochastic variability and enable persistence of populations in the face of this variability.

Objective CHIN3.1: Increase the survivals of juvenile and adult Chinook salmon populations using the Delta across the temporal distributions for each run.

The following ecosystem objective contributes towards achieving this goal: ECSY1.4.

Monitoring Metrics: Observation of variation in return age of cohorts

Observation of variation in juvenile emigration

strategies through migration period.

Monthly survival studies of juveniles and adults

across their temporal range

Metric targets: TBD

Goal CHIN4: Increase the proportion of each run of adult Chinook salmon that migrate successfully through the Delta to upstream spawning habitats.

Problem Statement: [To come.]

The following ecosystem and natural community objectives achieve this goal: ECSY1.2 and NACO1.1.

Monitoring metrics: TBD

Metric targets: TBD

Central Valley Steelhead

Goal STEE1: Increase the survivals of juvenile Central Valley steelhead rearing in and migrating through the Delta to contribute to the long-term viability of that steelhead population.

Problem Statement: Mortality rates of juvenile Central Valley steelhead attributable to multiple factors within the Delta are hypothesized to be excessive and a factor inhibiting the growth of the steelhead population. Reducing mortality rates of juvenile steelhead in the Delta will support improved abundance, distribution, diversity, and growth of the Central Valley steelhead population.

The following ecosystem, natural community, and general covered fish species objectives also contribute towards achieving this goal: ECSY1.1, ECSY1.3-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, GECF1.1-1.4, and GECF2.1.

Objective STEE1.1: Increase the survival of juvenile Sacramento Basin steelhead rearing in and migrating through the Delta to Chipps Island to levels that will contribute to the long-term viability of the population.

Monitoring metrics: Juvenile survival surveys

Mean annual juvenile survival rates of ___ percent averaged across ___ years. .

Objective STEE1.2: Increase the survival of juvenile San Joaquin Basin steelhead, including the Mokelumne and Cosumnes River steelhead, rearing in and migrating through the Delta to Chipps Island to levels that will contribute to the long-term viability of the population.

Monitoring metrics: Juvenile survival surveys

Metric targets: Mean annual survival rates of percent averaged across years.

Goal STEE2: Increase the growth of juvenile steelhead that migrate through and rear in the Delta to increase the likelihood for survival of juvenile steelhead in San Francisco Bay and ocean habitats.

Problem Statement: Vulnerability to poor ocean conditions is hypothesized to increase when salmonid smolts enter the ocean smaller than optimal. Riverine ecosystems tend to not be highly productive, while estuarine ecosystems tend to be more productive. It is hypothesized that smolts encountering these habitats need to grow rapidly to improve

ocean survivals. Increasing growth of juvenile steelhead in the Delta is expected to increase the likelihood of survival of juveniles.

The following ecosystem, natural community, and general covered fish species objectives also contribute towards achieving this goal: ECSY1.1, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, and NACO1.1-1.3.

Objective STEE2.1: Increase the mean weight and length of juvenile Sacramento Basin steelhead rearing in and migrating through the Delta to Chipps Island.

Monitoring metrics: Weight and length of juvenile salmonids

Metric targets: TBD

Objective STEE2.2: Increase the mean weight and length of juvenile San Joaquin Basin steelhead, including the Mokelumne and Cosumnes River steelhead, rearing in and migrating through the Delta to Chipps Island.

Monitoring metrics: Weight and length of juvenile salmonids

Metric targets: TBD

Goal STEE3: Increase life history diversity of Central Valley steelhead.

Problem Statement: The loss of life history diversity is expected to reduce the viability of salmonid populations. Life history is defined as the lifetime patterns in growth, life stage differentiation, and reproduction. For salmonids, life history traits include the timing of downstream juvenile out-migration, the timing and patterns of ocean rearing and migrations, the timing of adult in-migrations upstream, and the age of returning spawners. Retention of life history diversity is important for steelhead because it is hypothesized to buffer populations from increased environmental or stochastic variability and enable persistence of populations in the face of this variability.

Objective CHIN3.1: Increase the survivals of juvenile and adult steelhead populations using the Delta across the temporal distributions for each run.

The following ecosystem objective contributes towards achieving this goal: ECSY1.4.

Monitoring Metrics: Observation of variation in return age of cohorts
Observation of variation in juvenile emigration
strategies through migration period.
Monthly survival studies of juveniles and adults
across their temporal range.

Metric targets: TBD

Goal STEE4: Increase the proportion of all adult Central Valley steelhead populations that migrate successfully through the Delta to upstream spawning habitats.

Problem Statement: [To come.]

The following ecosystem and natural community objectives achieve this goal: ECSY1.2 and NACO1.1.

Monitoring metrics: TBD

Metric targets: TBD

Sacramento Splittail

Goal SASP1: Maintain and conserve a self-sustaining population of Sacramento splittail in the Delta.

Problem Statement: Sacramento splittail have been identified to be obligate floodplain spawners, and connectivity among habitats is critical to their viability. Additionally, numerous physical and biological stressors threaten the viability of this species. Actions to maintain Sacramento splittail focused on maintaining the abundance, spatial distribution, life history diversity, and growth rate of these fishes are expected to maintain the species current status.

The following ecosystem, natural community, and general covered fish species objectives also contribute towards achieving this goal: ECSY1.1-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, and GECF1.1-1.4.

Objective SASP 1.1: Contribute towards increasing the abundance of Sacramento splittail within the Delta and Suisun Bay such that the following conditions are met.

Monitoring metrics: FMWT surveys

Other surveys TBD

Metric Target #1. The FMWT numbers exceed 19 or greater for seven

of 15 years, the Suisun Marsh catch per trawl exceed 3.8 for seven out of 15 years, and young-of-year abundance exceed 3.1 per trawl for at least three out of 15 years (splittail young-of-year abundance can be applied to meet the total

abundance (i.e., 3.1 young per trawl can be applied to meet the 3.8 target).

Metric Target #2. Bay Study otter trawl numbers will be 18 or greater

and catch of young-of-year will exceed 14 for 3 out

of 15 years.

Objective SASP1.2: Maintain the distribution of Sacramento splittail within the Delta and Suisun Bay to achieve target distribution values.

Monitoring metrics: TBD

Metric targets: TBD

Objective SASP1.3: Maintain connectivity between Central Valley and Napa/Petaluma Sacramento splittail populations.

Monitoring metrics: TBD

Metric targets: TBD

Objective SASP1.4: Maintain multiple spawning cohorts of Sacramento splittail as part of the breeding population.

Monitoring metrics: TBD

Metric targets: TBD

Green Sturgeon

Goal GRST1: Increase the number of green sturgeon successfully migrating upstream and downstream through the Delta.

Problem Statement: Green sturgeon migrate upriver to spawning habitats in the late winter and spring when floodplains are inundated in the north delta. Floodplain flows are hypothesized to attract green sturgeon and potentially misguide or strand them in bypasses. Actions to reduce stranding, remove impassable barriers, and alleviate potential attraction of green sturgeon towards floodplains are expected to increase the number of green sturgeon successfully migrating upstream through the delta to upstream spawning habitats.

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⁷ This quantified objective has been proposed by DFG and is undergoing evaluation by the Biological Goals and Objectives Working Group.

The following ecosystem and natural community objectives achieve this goal: ECSY1.2 and NACO1.1.

Monitoring metrics: Adult sturgeon migration surveys at Red Bluff

Diversion Dam;

Benthic fish monitoring throughout the Delta;

Others TBD

Metric targets: TBD

Goal GRST2: Increase the spatial distribution of juvenile green sturgeon within the Delta.

Problem Statement: Habitat alteration is hypothesized to limit the amount of habitat for foraging and rearing by juvenile green sturgeon. Increasing the distribution of juvenile green sturgeon would suggest habitats are properly functioning for green sturgeon in the Delta.

The following ecosystem and natural community objectives achieve this goal: ECSY1.3-1.5 and NACO1.1-1.2.

Monitoring metrics: TBD

Metric targets: TBD

White Sturgeon

Goal WHST1: Increase the number of white sturgeon successfully migrating upstream and downstream through the Delta.

Problem Statement: [To come.]

The following ecosystem and natural community objectives achieve this goal: ECSY1.2 and NACO1.1.

Monitoring metrics: Adult sturgeon migration surveys at Red Bluff

Diversion Dam:

Benthic fish monitoring throughout the Delta;

Others TBD

Metric targets: TBD

Goal WHST2: Increase the spatial distribution of white sturgeon within the Delta.

Problem Statement: White sturgeon are resident fish in the Delta and require habitats for foraging and rearing. Habitat alteration, invasive species, and contaminants are hypothesized to be limiting factors for white sturgeon populations. Actions to increase the spatial distribution of white sturgeon are hypothesized to increase the abundance, life history diversity, population growth rate.

The following ecosystem and natural community objectives achieve this goal: ECSY1.3-1.5 and NACO1.1-1.2.

Monitoring metrics: TBD

Metric targets: TBD

Goal WHST3: Maintain multiple age classes of spawning cohorts of white sturgeon.

Problem Statement: [To come.]

The following ecosystem and natural community objectives achieve this goal: ECSY1.3-1.5, ECSY5.1, and NACO1.1-1.2.

Monitoring metrics: TBD

Metric targets: TBD

River Lamprey

Goal RILA1: Maintain the ecological functions of the Delta that support a self-sustaining population of river lamprey in the Central Valley.

Problem Statement: [To come.]

The following ecosystem, natural community, and general covered fish species objectives that also contribute towards achieving this goal: ECSY1.1-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, and GECF1.1-1.3.

Monitoring metrics: TBD

Metric targets: TBD

Pacific Lamprey

Goal RILA1: Maintain the ecological functions of the Delta that support a self-sustaining population of river lamprey in the Central Valley.

Problem Statement: [To come.]

The following ecosystem, natural community, and general covered fish species objectives that also contribute towards achieving this goal: ECSY1.1-1.5, ECSY2.1, ECSY3.1-3.2, ECSY4.1, ECSY5.1, NACO1.1-1.3, and GECF1.1-1.3.

Monitoring metrics: TBD

Metric targets: TBD

